[239] Attorney Docket No. : CPL-126US PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Tasso R. M. Sales
Appl. No.	:	10/072,014
Filed	:	February 7, 2002
For	:	HIGH-CONTRAST SCREEN WITH RANDOM MICROLENS ARRAY
Examiner	:	C. Mahoney
Group	:	2851

RESPONSE

I. Introduction

This is in response to the Office Action dated December 4, 2002. Submitted herewith is a petition under 37 CFR §1.136 and the required fee requesting a three month extension in which to file this response. Based on that extension, this response is due on June 4, 2003.

In reviewing the Office Action Summary (PTO Form 326) for this Office Action, it was noted that the box indicating acknowledgment of applicant's claim for domestic priority under 35 USC §119(e) was not checked. Applicant assumes that his claim for priority to provisional application number 60/267,037, filed February 7, 2001, and provisional application number 60/313,180, filed August 17, 2001, are of record in this application, but if not, such action is respectfully requested.

II. The December 4th Office Action

In the December 4th Office Action, the Examiner made various rejections of applicant's claims based on six references, in some cases taken alone and in others, in combination. Those references were:

(1) van de Ven, U.S. Patent No. 4,666,248 (van de Ven);

(2) Saitoh et al., U.S. Patent No. 5,870,244 (Saitoh et al.);

(3) Moshrefzadeh et al., U.S. Patent No. 6,317,263 (Moshrefzadeh);

(4) Shimizu, U.S. Patent No. 1,942,841 (Shimizu);

(5) Hashimoto et al., U.S. Patent No. 6,335,828 (Hashimoto); and

(6) Morris et al., PCT Patent Publication No. WO 02/10804 (Morris).

Applicant respectfully traverses these rejections for the following reasons.

III. The §102 Rejection Based on van de Ven

In his first rejection, the Examiner rejected Claims 1, 3, 5, 7-9, 12, 16, 29, 30-32, 35-37, 38, 40, 42-44, and 47 under 35 USC §102(b) based on van de Ven. Of this group of claims, only Claims 1, 38, 40, and 47 are independent claims. The following comments are directed to these independent claims, it being understood that in so doing applicant does not intend to suggest or imply that the dependent claims do not contain limitations which even further distinguish applicant's invention from van de Ven.

Beginning with independent apparatus Claim 1 and its related independent method Claim 40, these claims are directed to a problem regarding projection screens which applicant respectfully submits was not recognized by van de Ven or any of the other references cited by the Examiner and certainly was not previously solved by workers in the art.

The screens with which these claims are concerned are those that include an array of lenses and a layer of light-absorbing material which contains an array of apertures through which image light passes to a viewer. The problem that applicant discovered relates to apertures formed by passing aperture-forming illumination through the lens array. Unknown to the art but discovered by applicant was the fact that the index of refraction of the lenses varies sufficiently between the wavelength(s) used to form the apertures and the wavelengths of the image forming light so that the apertures can block some of the image forming light.

If this had simply meant that the image was somewhat dimmer, the problem would not be so bad since at least in principle, if not in practice, a stronger light source could be used to compensate for the reduction in intensity. But applicant also found that not all wavelengths of the imaging light were affected equally. Rather, it was the long wavelengths that the apertures blocked, thus skewing the spectral content of the image. Even the strongest light cannot solve this problem.

However, applicant found that the problem can be solved in an elegant manner. His solution, which is recited in both Claim 1 and Claim 40, is to employ a substrate that is associated with the lens array on one side and with the light-absorbing material on the other, and to careful pick the substrate's thickness to achieve the twin goals of keeping as much of the light-absorbing material as possible (e.g., more than 50% in Claim 1) but not at the expense of cutting off the long wavelength portion of the image forming light.

Figure 25 of applicant's specification, a copy of which is reproduced below, illustrates what applicant discovered.

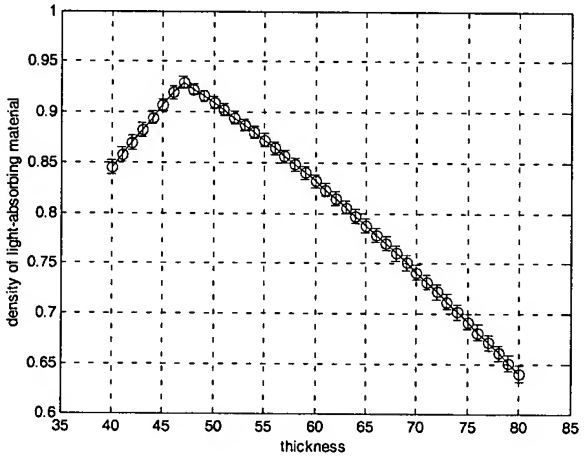

FIG. 25

This figure is a plot of density of light-absorbing material versus target substrate thickness for an exemplary microlens array. Among other things, the figure shows that a density of, for example, 90% (0.9) can be achieved for a target substrate thickness of around 44 microns or around 52 microns. Based on prior art knowledge, one would think that it does not matter which one is chosen. But it does.

As explained at, for example, page 29, lines 26-30, of applicant's specification, the thinner substrate thickness, e.g., 44 microns in Figure 25, "is undesirable since the small aperture prevents relevant image information associated with long wavelengths in the image-forming spectrum from being transmitted." See also applicant's Figure 6A. That is, for this example, the spectral content of the image becomes distorted if the target thickness is 44 microns, but does not if it is 52 microns. Yet, both thicknesses achieve the same density (0.9) for the light-absorbing layer.

The van de Ven reference has absolutely no recognition of this effect. The totality of its disclosure regarding its "foil 16" is as follows:

> The thickness of the foil is dictated by the desired focal length of the lens elements and by the mechanical stressed [sic] to which it is subjected during the production process. In practice, this foil has a thickness of between 0.2 and 0.5 mm. (van de Ven at column 4, lines 34-38)

Such a disclosure certainly does not anticipate (or render obvious) the limitations of independent Claim 1 which require a substrate having a target thickness τ such that:

> "(i) the apertures [of the layer of light-absorbing material] do not substantially block light at λ_{long}; and
>
> (ii) the ratio ρ of the area that is light blocking to the overall area exceeds 0.5"

where λ_{long} is the longest wavelength of the image-forming illumination.

Similarly, the total of 43 words that van de Van devotes to picking a foil thickness do not disclose or suggest the limitation of method Claim 40 which requires selecting "the optical properties of the microlenses and a target thickness for the substrate...so as to maximize the light-blocking area of the layer of light-absorbing material while allowing image-forming illumination to pass through the layer's apertures substantially unimpeded."

As succinctly summarized by Judge Learned Hand in Dewey & Almy Chemical Co. v. Mimex Co., 124 F.2d 986, 989, 52 USPQ 138, 142 (2d Cir. 1942):

> No doctrine of the patent law is better established than that a prior patent or other publication to be an anticipation must bear within its four corners adequate directions for the practice of the patent invalidated. If the earlier disclosure offers no more than a starting point for further experiments, if its teaching will sometimes succeed and sometimes fail, if it does not inform the art without more how to practice the new invention, it has not correspondingly enriched the store of common knowledge, and it is not an anticipation.

Plainly, van de Van cannot fairly be said to have enriched the art of projection screens in the area of selecting the correct thickness for a substrate between a lens array and a light-absorbing layer. That being the case, applicant respectfully submits that the Examiner's rejection of independent Claims 1 and 40, and their dependent claims, based on van de Van should be withdrawn.

The foregoing considerations also apply to independent Claim 47. Like Claims 1 and 40, Claim 47 is concerned with selecting the correct thickness for the substrate. In this claim, that thickness is defined in terms of two thin-lens paraxial focal lengths associated with the lens array, namely, f_{exp} and f_{max}, where f_{exp} is for the aperture-forming illumination and f_{max} is for λ_{long}, which again is the longest wavelength of the image-forming

illumination. As set forth in this claim, the target thickness τ of the substrate is selected in accordance with the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{exp}} + \frac{1}{f_{max}}.$$

Plainly, van de Ven does not in any way disclose or suggest this relationship or that it can be used to avoid the problem of spectral distortion due to the blocking of long wavelengths of image light by apertures formed in a layer of light-absorbing material. That being the case, the Examiner's rejection of this claim based on van de Ven should be withdrawn.

Turning to independent Claim 38, that claim is directed to the shape of the apertures in the layer of light-absorbing material. In broad outline, the claim requires the apertures to be either modulated lines, such as those shown in applicant's Figures 34 or 37, or ovals, such as those shown in applicant's Figures 35-36 and 38-39. In particular, the claim recites the following Markush group of 12 aperture configurations:

(1) horizontally modulated lines,

(2) vertically modulated lines,

(3) horizontal ovals,

(4) horizontal ovals in a hexagonal spatial arrangement,

(5) horizontal ovals in a square spatial arrangement,

(6) vertical ovals,

(7) vertical ovals in a hexagonal spatial arrangement,

(8) vertical ovals in a square spatial arrangement,

(9) horizontal ovals of varying sizes,

(10) horizontal ovals of varying sizes in a randomized spatial arrangement,

(11) vertical ovals of varying sizes, and

(12) vertical ovals of varying sizes in a randomized spatial arrangement.

As shown in his Figure 2, van de Ven's apertures are circular, plain and simple. Accordingly, there is no anticipation of applicant's independent Claim 38 by van de Ven.

In view of the foregoing, applicant respectfully submits that van de Ven does not anticipate or render obvious any of Claims 1, 3, 5, 7-9, 12, 16, 29, 30-32, 35-37, 38, 40, 42-44, or 47.

IV. The §102 Rejection Based on Saitoh et al.

In the December 4th Office Action, the Examiner cited Saitoh et al. under 35 USC §102(b) against Claims 1, 3, 12-13, 16-17, 31-32, 35-37, and 47-48. Of these claims, only Claims 1, 47, and 48 are independent claims. As was done with van de Ven, the following comments are directed to these independent claims without prejudice to applicant's right to rely on the added limitations of the dependent claims as providing further distinctions over Saitoh et al..

As discussed above, independent Claims 1 and 47 are directed to the problem of selecting the thickness of a substrate between a lens array and a layer of a light-absorbing material to achieve the twin goals of keeping as much of the light-absorbing material as possible but not at the expense of cutting off the long wavelength portion of the image forming light.

Independent Claim 48 is also directed to this problem. It differs from Claim 47 in that instead of using just the thin-lens paraxial focal lengths f_{exp} and f_{max} to determine the target thickness of the substrate, it takes into account variations in these focal lengths (Δf_{exp} and Δf_{max}) associated with lenses of finite thickness. Accordingly, instead of the equation set forth above for Claim 47, Claim 48 contains the following equation for determining the target substrate thickness τ:

$$\frac{2}{\tau} = \frac{1}{f_{exp} + \Delta f_{exp}} + \frac{1}{f_{max} + \Delta f_{max}}.$$

Like van de Ven, Saitoh et al. has nothing to do with the problem which applicant discovered and solved, namely, the problem that apertures produced using aperture-forming illumination can skew the spectral content of image illumination by blocking long wavelengths. Rather than this problem, the Saitoh et al. patent is concerned with a different problem, namely, the effect of the thickness of what the patent refers to as blocking stripes (BS) on the ability to view an image at wide angles. As stated in Saitoh et al.:

> [B]y controlling the thickness of the BS pattern so that the aperture rate is 90% or greater ... it is possible to view the entire surface of the aperture through which the projected light passes without any blockage of the observational light path, not only from directly in front of the screen, but also in cases where the screen is viewed from a wide angle to the left or right. Thus, a screen which produces a bright image can be obtained. (Saitoh et al. at column 7, lines 3-14.)

Particularly revealing as to the differences between the present invention and the Saitoh et al. reference is the fact that Saitoh et al.'s equations which appear at column 7, lines 15-18, do not depend on wavelength. Those equations read:

$$\theta = \tan^{-1} \{(P-P')/2D\},$$

$$\theta' = \tan^{-1} \{(P-P')/2(D+D')\}, \text{ and}$$

$$\text{aperture rate} = (\theta-\theta')/\theta,$$

where P is the pitch of Saitoh et al.'s convex cylindrical lenses, D is the thickness of their lenticular sheet, P' is the line width of their black stripe (BS) pattern and D' is the thickness of the BS pattern.

Applicant's equations of the type set forth in Claims 47 and 48 (see above) are wavelength dependent in that they contain a focal length for aperture-forming illumination (f_{exp}) and a focal length for the image-forming illumination, specifically, a focal length for the longest wavelength of that illumination (f_{max}).

Such a difference in equations is, of course, not surprising since, as discussed above, Saitoh et al. deals with a different problem than applicant's. However, the difference in equations does make it clear that Saitoh et al. in no way anticipates applicant's invention. In particular, this difference, as well as the rest of the Saitoh et al. disclosure, shows that Saitoh et al. had no idea that selecting a target thickness for a substrate located between a lens array and a layer of a light-absorbing material can eliminate the problem of long wavelength blocking while still providing a large area of light-absorbing material.

Under these circumstances, applicant respectfully submits that the rejection based on Saitoh et al. should be withdrawn.

V. The §103 Rejections

In the Office Action, the Examiner made various rejections under 35 USC §103(a). In particular, he rejected Claims 2, 4, 6, 33, 39, and 41 based on van de Ven in view of Moshrefzadeh, Claims 10-11, 34, and 45-46 based on van de Ven in view of Shimizu or Hashimoto, and Claims 13-15, 17-28, and 48-53 based on van de Ven in view of Morris.

The deficiencies in van de Ven are fully discussed above. None of the secondary references make up for these deficiencies. Put simply, none of these references recognize or solve the problem of long wavelength blocking by apertures formed in a layer of light-absorbing material.

Moreover, applicant does not agree that the secondary references disclose what the Examiner alleges they disclose. As just two examples, Moshrefzadeh does not show random interpolation between lenses of a lens array as called for by independent Claim 39 and Morris does not disclose the production of a screen having a randomized array of lenses in accordance

with the equations of independent Claims 50, 52, or 53.[1] In addition, applicant does not agree that the references provide motivation for the combinations proposed by the Examiner.

However, a further discussion of these §103 rejections is not considered necessary at this point in view of the fundamental differences between applicant's claims and the art. Put simply, applicant does not believe that the Examiner has established that any of Claims 2, 4, 6, 10-11, 13-15, 17-28, 33-34, 39, 41, 45-46, or 48-53 would have been obvious to a person of ordinary skill in the art based on a combination of van de Ven and a secondary reference.

VI. Conclusion

In view of the foregoing, applicant respectfully submits that the present application should be allowed. Accordingly, reconsideration and the issuance of a notice of allowance for this application are respectfully requested.

Respectfully submitted,

Date: 6/4/03

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[1] Applicant also believes that the Morris reference is not available for citation against the present application since its publication date (February 7, 2002) is the same as the filing date of this application (February 7, 2002) and after the February 7, 2001 and August 17, 2001 filing dates of applicant's provisional applications from which this application claims priority. There is a pending U.S. application corresponding to the Morris reference, i.e., U.S. application number 09/918,408, filed July 30, 2001, which was published on March 21, 2002, as US 2002/0034710 A1, but that application and the present application have been and currently are commonly owned by Corning Incorporated, either directly or through wholly-owned subsidiaries.